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# Association between occurrence and risk factors of chronic noncommunicable diseases and past food insecurity in adults from the Federal District, Brazil

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## Abstract

Studies indicate a possible link between food insecurity (FI) and the occurrence of chronic, non-communicable diseases (NCDs) in adults, and also the relationship between food deprivation in childhood and development of obesity in adulthood. However, the association between FI experienced in childhood and the occurrence of NCDs in adults has been little studied. This study aimed to investigate the association between past FI (PFI) and the occurrence of NCDs in adults from the Federal District (FD), Brazil. The sample is representative for the population of FD and included 291 individuals over 18 years old. To verify this association, the prevalence ratio of NCDs among individuals with previous food security and PFI was calculated. Of the analyzed sample, 56.4% presented PFI , and of these, 52.7% had overweight / obesity in adulthood. Although not significant, PFI increased the risk of cardiovascular disease by 14% (APR2 1.14, 95% CI :0.65-2, 00), diabetes by 57% (APR2 1.57, 95% CI :0.64-3.88) and cancer by 52% (APR2 1.52, 95% CI: 0.37-6, 29). Data show a tendency of PFI being associated with the occurrence of NCDs in adults. Further studies are needed to confirm this association.

**Key words:** Food Security. Childhood. Chronic Diseases. Obesity. Prevalence.

## Introduction

Food security consists in the human right to regular and continuous access to healthy and quality foods, in sufficient amounts, also taking into consideration cultural, environmentally sustainable and socioeconomic aspects.[1] It encompasses processes from agricultural production to the population's access to foods, all of them relating to the concept of food security.[2]

Food insecurity (FI), therefore, comprise conditions in which some factors prevent the individual's access to adequate foods, leading to situations of food deprivation and, in later stages, hunger. Several indicators, among them the Brazilian Food Insecurity Scale (BFIS), consisting of 14 questions, which provides a classification of four categories of household food security, can measure the population's FI level.[4] According to 2009 data of National Household Sample Survey (PNAD), 30.2% of Brazilian homes were in FI condition, comprising about 65.6 million people. Of the total homes assessed, 18.7% indicated mild FI, 6.5% fair FI and 5% serious FI.[4]

Some studies indicate the association of FI conditions with overweight and obesity,[5-8] and other chronic, noncommunicable diseases (NCDs), such as diabetes and hypertension.[9-12] Thus, they confirm that nutritional deficiencies and starvation are not the only forms of expression of such condition. [3] In addition, studies indicate the relationship between situations of lack of access to food experienced by individuals in the past with obesity in adult life. [13-18] However, a possible relationship between food insecurity experienced in childhood and the occurrence of NCDs in adulthood has been poorly studied.

This work aims to assess the association of food insecurity experienced in childhood and the occurrence of NCDs in adult individuals, in the Federal District, Brazil.

## Methods

A cross-sectional study was conducted in the first half of 2014 with an adult population in the Federal District (FD). The sample was randomly selected and stratified by food insecurity condition and household income range.[4] During the sample design stage, procedures for the population classification were accomplished, the percentage of each income class was determined, and the quota sampling was fixed in compliance with the proportion of classes considered. The calculated sample size comprised 291 individuals (male and female), with 10% maximum error and a 95% confidence interval. The sample studied has representativeness for individuals with serious food insecurity in the FD.

The criteria of exclusion included pregnancy, deaf and dumb individuals, or individuals with disabilities. The criteria of inclusion were the following: individuals aged 18 years or over, living in the FD, and being familiar with the availability of foods at home, i.e., individuals who are involved in the purchase, storage and regular consumption of foods by the family. Data were collected in face-to-face interviews in large population areas in the FD.

The instrument used was validated in a pilot study and consisted of: 1) a screening questionnaire, when the individuals were systematically approached and invited to participate in the survey, the monthly household income was collected and the questionnaire of the Brazilian Food Insecurity Scale (BFIS) was administered,[19,20] to assess the individuals' insecurity level and, therefore, to select individuals who meet the inclusion criteria; and 2) a questionnaire comprised of closed-end questions based on the questionnaire used by the VIGITEL 2011 survey, to assess the risk factors and protection involved in the occurrence of NCDs,[16] and the past BFIS, comprised of seven questions relating to food insecurity experienced in childhood at the age of 12 years, as employed in a previous study.[17] The BFIS questionnaire, which was administered in the screening stage, consisted of 14 questions about the experienced and/or perceived household food insufficiency and starvation in the three past months prior to the interview.[4] The questions of the after-screening questionnaire covered the following aspects: a) the individual's demographic and socioeconomic characteristics; b) dietary pattern and physical activity; c) individual's weight and height; d) health conditions in childhood; e) consumption of alcoholic beverage; f) self-assessment of health condition and previous medical diagnosis of NCD; g) questionnaire on Past Food Security (PFS) to determine possible influence of food safety conditions regarding access to foods during the individual's childhood.

To analyze the *status* of the individuals' food security in childhood, the individuals that answered "no" to the seven questions of the past BFIS were classified as having past food security (PFS). On the other hand, the individuals who answered "yes" to one or more questions were classified as having past food insecurity (PFI).

The present study was approved by the Research Ethics Committee of the University of Brasilia, process number 392.831. The individuals who agreed to attend the survey signed the Free and Informed Consent Form.

The estimates provided by bivariate analyses (relationship between past food insecurity and socioeconomic variables, and presence of chronic diseases) were expressed as prevalence ratios (PR) and 95% confidence intervals, and the chi-square test was used to compare the PFI observed. For the adjusted analysis, Poisson regression was used. Variables with $p<0.20$ and current food safety were included as control variables. The significance level considered was of 5%.

## Results

In this study, 291 adult individuals living in the Federal District were interviewed. Regarding age and ethnicity, the data of two participants were lost because they refused to provide information on the variables mentioned, as indicated in Table 1.

Table 1 shows that 56.4% of the respondents experienced past food insecurity. The majority of the sample was female (52.9%), and the respondents' average age was 38 years (standard deviation ±15.86 years). Regarding the educational background, 48.5% of the participants of the study had completed high school. Comparing the two groups (PFS and PFI), it could be seen that the group of individuals who had had PFI presented a greater prevalence of overweight/obesity in adulthood (52.7%). Considering the total sample, the mean BMI obtained for men and women was 24.98 and 25.37 kg/m$^2$, respectively, both classified as overweight.

**Table 1.** Socio-demographic characteristics of the sample according to past food security condition. Brasília-DF, 2014.

| | Total | | Past Food Security | | Past Food Insecurity | | p – value[&] |
|---|---|---|---|---|---|---|---|
| | N | % | N | % | n | % | |
| Sex | | | | | | | |
| Female | 154 | 52.9 | (64) | 50.4 | (90) | 54.9 | 0.447 |
| Male | (137) | 47.1 | (63) | 49.6 | (74) | 45.1 | |
| Age* | | | | | | | 0.021 |
| 18 – 29 | (105) | 36.1 | (59) | 46.8 | (46) | 28.2 | |
| 30 – 39 | (53) | 18.3 | (20) | 15.9 | (33) | 20.2 | |
| 40 – 49 | (62) | 21.5 | (23) | 18.3 | (39) | 23.9 | |
| 50 – 59 | (34) | 11.8 | (10) | 7.9 | (24) | 14.7 | |
| 60 or over | (35) | 12.1 | (14) | 11.1 | (21) | 12.9 | |
| Mean age (SD) | 38 years (SD±15.86****) | | 35 years (SD±16.26) | | 41 years (SD±15.12) | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Education | | | | | | | 0.342 |
| Primary school | (73) | 25.1 | (21.3) | 27 | (46) | 28 .0 | |
| Secondary school | (141) | 48.5 | (47.2) | 60 | (81) | 49.4 | |
| Higher education | (63) | 21.6 | (26.8) | 34 | (29) | 17.7 | |
| Post-graduation | (8) | 2.7 | (3.1) | 4 | (4) | 2.4 | |
| Did not study | (6) | 2.1 | (1.6) | 2 | (4) | 2.4 | |
| Race**, | | | | | | | 0.947 |
| White | (71) | 24.4 | (32) | 25.4 | (39) | 23.9 | |
| Black/Brown | (207) | 71.1 | (89) | 70.6 | (118) | 72.4 | |
| Yellow/Indigeneous | (11) | 3.8 | (5) | 4.6 | (6) | 3.7 | |
| Currently employed | (229) | 78.7 | (98) | 77.2 | (131) | 79.9 | 0.575 |
| Household income per capita, | | | | | | | 0,004 |
| Up to ¼ minimum wage | (20) | 6.9 | (3) | 2.4 | (17) | 10.4 | |
| Over¼, up to ½ minimum wage | (49) | 16.8 | (15) | 11.8 | (34) | 20.7 | |
| Over½, up to 1 minimum wage | (72) | 24.7 | (31) | 24.4 | (41) | 25.0 | |
| Over 1, up to 2 minimum wages | (79) | 27.1 | (36) | 28.3 | (43) | 26.2 | |
| Over 2 minimum wages | (67) | 23 | (39) | 30.7 | (28) | 17.1 | |
| No income | (4) | 1.4 | (3) | 2.4 | (1) | 0.6 | |
| Marital status, | | | | | | | 0.001 |
| Single/Separated/Widow(er) | (176) | 60.5 | (90) | 70.9 | (86) | 52.4 | |
| Married/Stable union | (115) | 39.5 | (37) | 29.1 | (78) | 47.6 | |
| BMI Men, mean, kg/m²*** | 24,98 | | 24.25 | | 25.72 | | |
| BMI Women, mean, kg/m²*** | 25,37 | | 24.99 | | 25.76 | | |
| Overweight/obesity*** | (140) | 49.1 | (55) | 44.4 | (85) | 52.8 | 0.061 |
| Classification of Past Food Security (n=291) | 100% | | 43.6% | | 56.4% | | |

Total sample (n = 291); *Age (n = 289); **Race (n = 289); ***BMI/Overweight/obesity (n = 285);****Standard Deviation calculated by the chi-square test (comparison between Past Food Security and Insecurity)

Table 2 shows the prevalence of NCDs according to the PFS condition. Among the individuals with PFS, prevalence of cardiovascular diseases was 16.5%, type 2 diabetes *mellitus* was 5.5% and cancer was 2.4%. In the PFI group, prevalence of these diseases was always higher. However, the results were not statistically significant, even when adjusted for age, *per capita* income, marital status, BMI and current classification of food security.

**Table 2.** Prevalence and prevalence ratio of the association of past food security with chronic diseases in residents of the Federal District. Brasília-DF, 2014.

| | Past Food Security Non-adjusted prevalence, % | Past Food Insecurity Non-adjusted prevalence, % Raw Prevalence Ratio (95% CI)* | Raw Prevalence Ratio (95% CI)* | Adjusted Prevalence Ratio 1 (95% CI)** | Adjusted Prevalence Ratio 2 (95% CI)*** |
|---|---|---|---|---|---|
| Cardiovascular diseases n = 291 | 16.5 | 24.4 | 1.48 (0.92 –2.37) | 1.25 (0.72 –2.18) | 1.14 (0.65 –2.00) |
| Diabetes n = 291 | 5.5 | 10.4 | 1.88 (0.81 –4.4) | 1.61 (0.66 –3.94) | 1.57 (0.64 –3.88) |
| Cancer n = 291 | 2.4 | 4.3 | 1.81 (0.48 –6.85) | 1.71 (0.43 –6.84) | 1.52 (0.37 –6.29) |

*Relative risk for adults with past food insecurity compared with adults with past food security. **Adjusted prevalence ratio 1 is adjusted for age, per capita income, marital status and BMI. ***Prevalence Ratio 2 is adjusted for age, per capita income, marital status, BMI, and current classification of food security.

## Discussion

Past food insecurity corresponds to situations of food deprivation experienced in childhood. Thus, memory biases should be considered in this study, despite using a previously validated questionnaire.[17]

It is known that situations experienced by individuals in childhood may influence the occurrence of NCDs in adult life, such as, for example, metabolic imprinting, a phenomenon in which early nutritional experiences in critical periods of the individual's development (perinatal) – pregnancy and infancy – may generate future effects that may predispose the individual for some diseases.[18] Overweight / obesity, cardiovascular diseases, among others, in adult life, are examples of such outcomes.

Authors have pointed out that deprivation, either quantitative or qualitative, of access to foods during childhood, is associated with the onset of obesity in adults.[13-15] As obesity is one of the risk factors for the development of NCDs, one can raise the hypothesis that the risk for the development of these diseases in individuals exposed to PFI conditions may also be increased, as the tendency of the results observed in this study indicates, although not significant.

It is observed that there is a tendency that food insecurity experienced during the individual's childhood increases the risk for the development of such NCDs in adulthood. Some studies have found an association of food insecurity and the occurrence of some chronic, noncommunicable disease in adulthood, such as diabetes and hypertension. [9-12] However, these studies consider the *status* of current, not past, food insecurity of the individuals studied.

## Conclusion

Based on the data found in the present work, further studies on past food insecurity are suggested to confirm the hypothesis raised herein.

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